Beetles and piñons shed light on world's ecology

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by Chonggang Xu

In spring 2004, the Southwest landscape was littered with barren piñon pines after a drought ravaged the region. Anyone walking or driving through the high desert saw legions of toppled, rotting trees, with up to 80 percent of piñons wiped out in some areas. The final death blow for many of the pines was not the drought directly, but instead the piñon ips beetles that flourished over an unusually warm winter and subsequently feasted beneath the bark of drought-weakened trees.

As bad as things were, they could have been worse, were it not for population dynamics that likely put a damper on the ips bark beetle invasion initiated by the drought. The beetles are tiny, between 3 and 5 millimeters long at maturity, and a seemingly insignificant factor in understanding the environment. The fact that a full grasp of the planet's ecology must take into account the behavior of such a minute insect is a testament to the complexity that's involved in understanding the Earth's environment.

In nondrought years, piñons protect themselves by secreting resin sap that traps and kills attacking insects. When water is scarce, trees don't have enough moisture to produce the sap to fight off parasitic beetles. That's particularly true after a mild winter has allowed large numbers of beetle larvae to survive until the spring. The warmer temperatures and more intense droughts that accompany climate change substantially increase the risk of insect outbreaks, such as the piñon ips event in the Southwest and a more recent mountain pine beetle infestation that affected regions of North America from New Mexico to British Columbia, Canada.

Cold winters are one of the primary factors that keep mountain pine beetles in check. In warmer winters, more beetles survive, allowing them to expand beyond their native ranges. There are great concerns about the potential expansion of mountain pine beetle to the north and east of North America. However, the system is complex. Here's the twist: The survival rate can be high enough in warm years that the beetles attack trees in numbers so large that they exceed the available resources. Juvenile beetles by the thousands swarming a single tree wind up starving before they can mature and move on to infest other trees.

In a study of pine trees in Alberta, Canada, Los Alamos ecologists found that despite the devastation the beetles often cause after an unusually warm winter, overcrowding slams the brakes on population growth, leaving some of the susceptible trees unscathed. The powerful overcrowding effect can make the damage from a beetle population explosion difficult to measure.

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